

HW Set #9

Due start of class on 11/30/10

Work the following problems in chapter 10

40, 46, 50, 54, 58, 62

1. Show that in the limit that the volume goes to infinity that the van der Waals equation of state reduces to the ideal gas equation of state.
2. Use the atomic radii of He, Ar, and Xe to estimate the van der Waals  $b$  constant for those three gases. How do these values compare to tabulated values (you'll need to find the radii and tabulated values somewhere)
3. Another equation of state for a gas is the hard sphere equation of state. This assumes the gas behaves like hard spheres: repulsions only.

$$P(V - nb) = nRT$$

Find a formula for  $Z$  for this gas. Sketch what  $Z$  looks like as a function of  $P$ .

4. Given that thermal expansion coefficient for iron is  $3.54 \times 10^{-5} \text{ K}^{-1}$ , what volume change would you expect for a 1 L bar of iron in going from  $0^\circ\text{C}$  to  $30^\circ\text{C}$  (typical winter to summer variations).

What if you have a 100 m bar of iron that was 10 cm x 10 cm in cross section. How much would its volume change? If the change was proportional to each direction how much longer would the bar be in the summer ( $30^\circ\text{C}$ ) compared to the winter ( $0^\circ\text{C}$ )?

5. For which of the following would you expect hydrogen bonding?

Butanol, pentanal, propanoic acid, diethyl ether, butyl amine, and ethyl butanoate

6. Why is it not possible to raise the vapor pressure of a liquid to a value that is higher than the ambient pressure?

7. Which of the following is exothermic?

melting, deposition, condensation, vaporization, sublimation, freezing